Description

Pressurized Gas Sampling Container

Technical Field

This pressurized gas sampling container relates to the collection, transportation and analysis of gas samples which may be required in various scientific, environmental and resource contexts. As an example, in oil and natural gas exploration, drilling, recovery and storage, periodic sampling of recovered gases and fluid are required for subsequent analysis. In the oil industry, "mud" is a colloquial term for a thick chemical composition that is pumped into drills as they penetrate the substrate. This "mud" is returned to the surface and contains gases that are released from the rock as the drill penetrates. Significant data is acquired from the analysis of these gases.

Background Art

International Publication Number WO 01/79805 A1 discloses a non pressurized sampling container in conjunction with a sampling apparatus. This system and non-pressurized sampling container is widely used in the gas sampling industry specifically, in the mud gas sampling sector. United States Patent 5,116,330 to Spencer provided for a sample extraction system with a sampling container and valves. Such a sampling system requires the interruption of the fluid flow as sampling containers are exchanged. Further, extraction of the sample from the sampling container was accomplished by "bleeding" the container, a technique which relies on gravity and is suitable for fluids in a liquid rather than a gaseous state. Although less common today, the gas sampling industry utilizes sampling bags which have the obvious problems of fragility, occupying a significant volume when being shipped and the inability to contain gas or fluid under any significant pressure.

Disclosure of the Invention

This pressurized tube facilitates the recovery and transportation of gas samples. This pressurized sampling container, made from aluminum will be usable at pressures up to 270 pounds per square inch (1860 kPa), however, other materials such as steel or plastic, other

polymers, carbon fiber and other metals may allow higher pressures. There are several advantages in utilizing pressurized gas sampling containers. High pressure containers are very expensive and with valves and end caps, can exceed $200.00 per unit. The present invention will retail at approximately $25.00 per unit. More fundamentally, there are currently no readily available low pressure sampling containers on the market with the advantage of flow through gas collection. These types of containers are difficult to purge and thus samples collected in them are generally contaminated with whatever materials were previously in the container.

Further, by compressing the gas, the amount of sample that can be collected is several times larger than with the non-compressed gas sampling containers or tubes. For example, at 150 psi, the amount of sample is actually 11 times as much as a non compressed sample in the same size container. This larger sample size allows additional analyses to be carried out that could not be done on the non-compressed gas sampling containers or tubes. It is anticipated that this container will meet or exceed the United States Department of Transportation requirements for the shipping of compressed gases. Specifically, It is acceptable for shipment of compressed flammable gases under the US Department of Transportation classification UN2037, RECEPTACLES, SMALL, CONTAINING GAS. It is also anticipated the container will meet or exceed similar standards in other countries.

The use of low pressure sampling containers will also simplify shipping. With the currently used non-compressed gas sampling containers or tubes, depending on size, a maximum of 8 per box could be shipped on passenger aircraft and, according to the regulations of the International Air Transport Association (IATA), up to 40 per box could be shipped on cargo-only aircraft. This is a significant disadvantage because many areas of the world do not have cargo-only aircraft service. Because the projects for which the gas sampling containers or tubes are used involve collection of as many as 200 to 300 samples, shipping in small groups is very inefficient and expensive. This has resulted in some samples being sent by ship with a resultant delivery times of several months. For non-compressed gases, shipping quantities are given as volumes (1 liter for passenger aircraft, 5 liters for cargo-only aircraft). For compressed gases, quantity limitations are by net weight. The invention is suitable for the transportation of many kinds of gases, however, consider, for example, using the container to ship natural gas samples. Natural gas is mostly methane and

generally lighter than air. Thus, the quantity that can be shipped in one outer package, even on passenger aircraft, is so large that it presents no practical limitation. 25, 50, or even 100 of the compressed gas containers per box will meet regulations.

The ability to ship pressurized samples will also simplify sample collection. Often the lines or apparatus from which gases must be collected is pressurized. An example is the collection of mud gases from oil and gas well drilling operations. In some cases the sample must be drawn from a line that is pressurized to 25 or 30 psi. With the non-compressed gas sampling containers or tubes, it was necessary to reduce the pressure in the container to atmospheric pressure before they could be shipped. This was a complicating factor and resulted in some samples actually being shipped improperly.

The invention has valves on both ends which can be opened and closed independently and which allow the container to be purged by simply flowing the sample gas through it. As long as the quantity of sample gas available is not limiting, the container does not have to be evacuated prior to use. The valves are simple, reliable, self sealing and inexpensive and the invention is readily adaptable for use with automated sample collection and analysis systems.

Brief Description of the Drawings

Fig. 1 is a cross sectional view of the sampling container.

Fig. 2 is a plan view of the container first body end.

Fig. 3 is a plan view of the mountable body cap.

Fig. 4 is a perspective view of the demountable pin activated valve and mountable body cap in place within the open end of the sampling container.

Fig. 5 is a cross section view of the demountable pin activated valve housing.

Fig. 6 is a cross section view of the demountable pin activated valve.

Best Mode for Carrying Out the Invention

Fig. 1 shows a cross section of a sampling container body (15) having a closed first body end (10), through which is perforated by circular container aperture (8) and through which first demountable pin activated valve is disposed. An elevation view of closed first body end (10) is seen in FIG. 2, which also exhibits aperture 8. Turning again to Fig. 1 it is seen that container walls (16) extend toward second body end (19). The second body end

(19) exhibits a rolled body cap seat (18) formed by container wall (16) being formed inward toward the longitudinal midline of the container then outward to such an extent that container wall (16) touches itself at point (17) thus forming the annular ring. (47). Mountable body cap (20) is shown in Figs. 1, 3 and5. Mountable body cap (20) is cup shaped and of such a diameter that body cap walls (23) communicate with rolled body cap seat (18) yet allows body cap base (22) to slide within sampling container body (15) allowing partially rolled flange (26) to also communicate with rolled body cap seat (18). Partially rolled flange (26) is formed in such a way as to allow inner curved surface (27) to communicate with outer annular ring upper surface (28) of rolled body cap seat (18). Seal (25) is annular in shape and rests on the inner curved surface (27). When mountable body cap (20) is fully inserted into sampling container body (15), partially rolled flange (26) communicates with seal (25) which, in turn, communicates with rolled body cap seat (18) forming an air or gas tight seal. When partially rolled flange (26) is then further rolled or crimped, the flange end (29A), is pressed under rolled body cap seat (18) onto annular ring lower external surface (30). This tightly compresses seal (25) allowing sampling container body (15) to be so tightly sealed as to allow sampling container body (15) to contain compressed gasses or liquids. Sampling container body (15) will be composed of aluminum, steel or other substance of suitable strength for compressed gasses and liquids. Circular cap aperture (24) is substantially the same diameter as circular container aperture (8). First demountable pin activated valve assembly (2) is inserted through circular container aperture (8) such that valve first end (4) is exterior to sampling container body (15) and valve second end (6) is interior. Valve lip (14) causes valve second end (6) to be retained with sampling container body (15) and also allows the compression of seal (12) between valve lip (14) and first body end (10). Second demountable pin activated valve assembly (2A) is substantially similar to Fig. 5, as is first demountable pin activated valve assembly (2) and it can be seen that second demountable pin activated valve assembly (2A) exhibits external threads, specifically first external thread (40) and second external thread (41). Returning to Fig. 1 it is seen that first demountable pin activated valve assembly (2) will accept washer (3) over valve first end (4) and will also accept internally threaded nut (5) such that when internally threaded nut (5) is threaded over the first external thread (40) of first demountable pin activated valve assembly (2) it tightens and compresses seal (12) between valve lip (14) and first body end (10) allowing a sufficient

seal to retain compressed gasses. Second demountable pin activated valve assembly (2A) is inserted through cap aperture (24) with valve first end (4A) exterior to sampling container body (15) and valve second end (6A) inside c sampling container body (15) when mountable body cap (20) is inserted into sampling container body (15) and resting on annular ring upper surface (28). Fig. 4 illustrates mountable body cap (20) inserted through second body end (19) with second demountable pin activated valve assembly (2A) in proper position through circular cap aperture (24). Fig. 4 also illustrates an alternative crimping method wherein a portion of the body cap walls (23) is expanded into expanded lip (29) such that expanded lip (29) applies pressure under rolled body cap seat (18) on annular ring internal lower surface (17A). This, in turn causes partially rolled flange 26 to seat on the upper surface of rolled body cap seat (18) causing seal (25) to be compressed thus sealing the container. Both illustrated crimping method may be used independently or in conjunction.

Turning now to Fig. 5, the first demountable pin activated valve assembly (2) is illustrated. It is composed of a transverse base (78) and valve housing (79). Valve housing 79), which is attached to the transverse base (78), exhibits external thread (40) and second external thread (41). Central bore (110) extends through both transverse base (78) and the valve housing (79). The valve first end (4) exhibits both external threads (41) and internal threads (42) within the central bore (110). The central bore (110) exhibits a conical narrowing; the central bore valve seat section (82). It is here that a (85) is seated. Second demountable pin activated valve assembly (2A) is configured substantially similar to that of first demountable pin activated valve assembly (2).

Turning now to Fig. 6 demountable pin activated valve (85) is shown. Demountable pin activated valve (85) is composed of a valve body (86) having a central cavity (90). Externally threaded first demountable pin activated valve body end (91) has a central bore (92) and a plurality of apertures (93) that communicate with the central cavity (90). The second demountable pin activated valve body end (94) also exhibits a corresponding central bore (95) with an annular space also communicating with the central cavity (90). The exterior of the valve body (86) exhibits a conical demountable pin activated valve body segment (105.) A demountable pin activated valve body gasket (114) is seated around the conical demountable pin activated valve body segment (105) and substantially corresponds to the shape of the central bore valve seat section (82) shown in

Fig. 5. Within the central cavity (90) area first sealing pin support (96) having a central bore (97) and a plurality of apertures (98). The first sealing pin support (96) is fixed to the interior walls of the central cavity (90). A second sealing pin support (99) also has a central bore (100) and a plurality of apertures (101). The second sealing pin rod support (99) is also fixed to the interior walls of the central cavity (90). Thus the central bores of the second demountable pin activated valve body end (94), the second sealing pin support (99), the first sealing pin support (96) and the first demountable pin activated valve body end (91) all correspond such that sealing pin (87) can be disposed through all. Sealing pin (87) has a first sealing pin end (103) disposed outside central cavity (90) and above valve body (86). A second sealing pin end (104) is also disposed outside the central cavity (90) and below valve body (86). P Sealing pin (87) also exhibits spring stop (115) fixed to sealing pin (87) between first sealing pin rod support (96) and second sealing pin rod support (99) but at a point on sealing pin (87) where the spring stop (115) communicates with the interior surface of the first sealing pin rod support (96) when in a resting position. The resting position is maintained by spring (89) disposed over the sealing pin and communicating with spring stop (115) and the second sealing pin rod support (99). Fixed to the second sealing pin end (94) in such a manner as to preclude leakage around the sealing pin (87) is sealing pin gasket (88). Sealing pin gasket (88) seals the central bore (95) and annular space (102) of second sealing pin valve body end (94) by being held against the second sealing pin valve body end (94) by the pressure exerted by spring (89) on spring stop (115). Now returning to Fig. 5, it can be seen that when second sealing pin valve body end (94) of demountable pin activated valve (85) is inserted into first annular section end (80) of first end cap valve body (77), externally threaded first demountable pin activated valve body end (91) may be disposed within the internal threads of first annular section end (80). Disposition of demountable pin activated valve (85) is to such a depth as to press demountable pin activated valve body gasket (114) firmly against central bore valve seat section (82) creating a seal.

When first valve 2 and second valve 2A are inserted within their respective apertures, the cap sealed within the sample container, and demountable pin activated valves are mounted within the valves, the sample container then obtains the ability to seal within it a gas sample. The demountable pin activated valves, when fluidly connected to

an apparatus capable of depressing the sealing pin yet maintaining a seal (such as that seen in International Publication Number WO 01/79805 A1, that is an injection and extraction means, it will result in injection, extraction or flow through of a pressurized gas sample.

Industrial Applicability

This pressurized gas sampling container finds application in the oil and gas industry and any industry or application in which the discrete or continuous sampling of gases or fluids are required in which a pressurized sample is desired which needs to be economically an efficiently transported to a location where the sample is removed for testing.